MECHANICS.

Conducted by B. F. FINKEL, Springfield, Mo. All contributions to this department should be sent to him.

SOLUTIONS OF PROBLEMS.

40. Proposed by F. P. MATZ, Sc. D., Ph. D., Professor of Mathematics and Astronomy in Irving College, Mechanicsburg, Pennsylvania.

Find the law of the force, in order that the orbit may be a Cassinian Oval.

Solution by G. B. M. ZERR, A. M., Ph. D., Texarkana, Arkansas-Texas.

Let $r^4+2c^2r^2\cos2\theta=m^4-c^4=a^4$ ......(1) be the equation to the oval. Then $a^4u^4=2c^4u^2\cos2\theta+1$, where $u=1/r$.

$$\frac{du}{d\theta}=\frac{c^2u\sin2\theta}{c^2\cos2\theta-a^4u^2}\dots\dots\dots\dots(2).$$

$$\frac{d^2u}{d\theta^2}=\left\{\frac{(c^2\sin2\theta\frac{du}{d\theta}+2c^2u\cos2\theta)(c^2\cos2\theta-a^4u^2)+(2c^2\sin2\theta+2a^4u\frac{du}{d\theta})c^2u\sin2\theta}{(c^2\cos2\theta-a^4u^2)^2}\right\}$$

$$=\left\{\frac{3c^4r^8+10r^4c^4m^4-3r^4c^8-(m^4-c^4)^3-7r^4m^8+9r^8m^4-r^{12}}{r(a^4+2r^4)^3}\right\}.$$

$$F=\text{force}=h^2u^2(u+\frac{d^2u}{d\theta^2})=\frac{h^2}{r^3}+\frac{h^2}{r^2}\cdot\frac{d^2u}{d\theta^2}.$$

$$\therefore F=\frac{h^2(7r^{12}+21r^8m^4+3r^4c^8-9c^4r^8-2c^4m^4r^4-m^8r^4)}{r^3(m^4-c^4+2r^4)^3}$$

$$=\frac{h^2\{7r^9+21m^4r^5-9c^4r^5+3rc^8-2c^4m^4r-m^8r\}}{(m^4-c^4+2r^4)^3}.$$

41. Proposed by O. W. ANTHONY, M. Sc., Professor of Mathematics, Columbian University, Washington, D. C.

If the earth were a perfect sphere and had a frictionless surface, what would be the motion of a ball placed at a given latitude?

[No solution of this problem has been received. EDITOR].

42. Proposed by O. W. ANTHONY, M. Sc., Professor of Mathematics, Columbian University, Washington, D. C.

Find the time of vibration of a particle slightly displaced from the center of a solid cylinder in direction of the axis, the matter of the cylinder attracting according to the laws of nature.